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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/579,021

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Geoffrey Spence

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MCDONNELL BOEHNEN HULBERT & BERGHOFF LLP  
300 S. WACKER DRIVE  
32ND FLOOR  
CHICAGO, IL 60606

EXAMINER

BARBEE, MANUEL L

ART UNIT

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/579,021	<b>Applicant(s)</b> SPENCE ET AL.	
	<b>Examiner</b> MANUEL L. BARBEE	<b>Art Unit</b> 2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 06 February 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 2-9, 13-20, 24-31 and 35-43 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 38-43 is/are allowed.
- 6) ☒ Claim(s) 2-9, 13-20, 24-31 and 35-37 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 February 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 2, 3, 6-9, 13, 14, 17-20, 24, 25, 28-31 and 35-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,959,966 to Torkkola (Torkkola) in view of "Characteristic-function-based independent Component Analysis" in Signal Processing, October 2003, Vol. 83, No. 10 by Eriksson et al. (Eriksson).  
As per claims independent claims 35-37:

With regard to processing signals associated with pairs of windows of data each having a leading window and a following window, Torkkola teaches using a sliding window to process samples and using the separation matrix from the first window as an initial value in the second window (col. 11, line 60 - col. 2, line 30).  
With regard to producing independence initialised signals by using further results obtained in connection with the respective leading window to initialise independence of signals and updating independence of independence initialised signals using following window data to produce independence updated signals designated as separated signals, Torkkola teaches learning a separation matrix for a first window and the separation matrix is used in the next window to learn

the next separation matrix (col. 12, lines 11-30). The separation matrix corresponds to independence initialised signals because the signals in the matrix are separate or independent.

Torkkola does not teach producing orthogonality initialized signals by using results obtained in connection with the respective leading window to initialize orthogonality of signals associated with the following window and updating orthogonality of initially orthogonalised signals using following window data to produced updated orthogonalised signals. Eriksson teaches a Jacobi type optimization to produce independent sources and optimizing orthogonality (p 2201, Section 4 and 4.1). Since orthogonality is optimized obviously the signals are initially orthogonalised. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the blind separation, as taught by Torkkola, to include Jacobi-type orthogonal optimization, as taught by Eriksson, because then the objective function would have been minimized using computationally convenient expressions (Eriksson, p 2210, Section 4).

As per claims 2, 13 and 24:

Torkkola does not teach updating orthogonality using small updates to produce decorrelation in a second order statistics procedure. Eriksson teaches a Jacobi type optimization to produce independent sources and optimizing orthogonality (p 2201, Section 4 and 4.1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the blind separation, as taught by Torkkola, to include Jacobi-type orthogonal optimization, as taught by

Eriksson, because then the objective function would have been minimized using computationally convenient expressions (Eriksson, p 2210, Section 4).

As per claims 3, 14 and 25:

Torkkola does not teach a technique referred to as Jacobi and involving diagonalisation of a symmetric matrix by determining and applying rotations iteratively until off-diagonal elements of the matrix become substantially equal to zero. Eriksson teaches a Jacobi type optimization to produce independent sources and optimizing orthogonality (p 2201, Section 4 and 4.1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the blind separation, as taught by Torkkola, to include Jacobi-type orthogonal optimization, as taught by Eriksson, because then the objective function would have been minimized using computationally convenient expressions (Eriksson, p 2210, Section 4).

As per claims 6, 17 and 28:

With regard to an acquisition phase in which signals are separated and desired signals are identified and a subsequent phase in which only desired signals are processed to separation, Torkkola teaches removing the components of other mixed signals to recover a source signal (col. 4, lines 1-12).

As per claims 7, 18 and 29:

With regard to statistical measures of data, Torkkola teaches a separation matrix (col. 11, line 60 - col. 12, line 30).

As per claims 8, 19 and 30:

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With regard to processing a first leading window and processing following windows by iteratively updating immediately preceding results using subsequent data snapshots to produce snapshot results and combining the snapshot results with the immediately preceding results that are obtained in a respective immediately preceding update, Torkkola teaches using a sliding window to process samples and using the separation matrix from the first window as an initial value in the second sample window (col. 11, line 60 - col. 12, line 30).

As per claims 9, 20 and 31:

With regard to a forget factor to implement fading in the following window, Torkkola teaches keeping up with fading corresponding to the speed of the transmitter and the receiver (col. 11, line 60 - col. 12, line 30).

3. Claims 4, 5, 15, 16, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Torkkola in view of Eriksson as applied to claims 3, 14 and 25 above, and further in view of US Patent Application Publication 2001/0044719 to Casey (Casey).

Torkkola and Eriksson teach all the limitations of claim 3 upon which claims 4 and 5 depend, claim 14 upon which claims 15 and 16 depend and claim 25 upon which claims 26 and 27 depend.

As per claims 4, 15 and 26:

With regard to using results obtained for each leading window to initialize independence of decorrelated signals associated with the respective following window in a second stage using independent component analysis to apply small

rotation updates to initialise signals, Eriksson further teaches a Jacobi type optimization to produce independent sources and optimizing orthogonality (p. 2201, Section 4 and 4.1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the blind separation, as taught by Torkkola, to include Jacobi-type orthogonal optimization, as taught by Eriksson, because then the objective function would have been minimized using computationally convenient expressions (Eriksson, p. 2210, Section 4).

Torkkola and Eriksson do not teach higher than second order statistics. Casey teaches cumulative expansions up to the fourth order (par. 39). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the blind separation combination, as taught by Torkkola and Eriksson, to include expansions up to the fourth order, as taught by Casey, because then features would have been extracted from recorded signals (Casey par. 39).

As per claims 5, 16 and 27:

Torkkola and Eriksson do not teach third or fourth order statistics procedure.

Casey teaches cumulative expansions up to the fourth order (par. 39). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the blind separation combination, as taught by Torkkola and Eriksson, to include expansions up to the fourth order, as taught by Casey, because then features would have been extracted from recorded signals (Casey par. 39).

***Allowable Subject Matter***

4. Claims 38-43 are allowed.
5. The following is a statement of reasons for the indication of allowable subject matter: The primary reason for the allowance of claims 38, 40 and 42 is because the prior art of record does not teach a method for dynamic blind signal separation including processing signals associated with pairs of windows of data that includes an acquisition stage of processing a first leading window of data to obtain first results that include a mean vector of signal samples, a covariance matrix of a data matrix of the first leading window and a fourth order tensor obtained from a moment of signal vectors derived by decorrelation and normalization of the data matrix.

The primary reason for the allowance of claims 29, 41 and 43 is because the prior art of record does not teach a method for dynamic blind signal separation that includes an acquisition stage and a subsequent stage of processing that includes iteratively updating preceding results using subsequent data snapshots to produce snapshot results that include a mean snapshot vector and a snapshot covariance matrix, a decorrelated and normalized snapshot equivalent providing signals from which to obtain their moment as a fourth order tensor update, the immediately preceding results being those obtained in a respective immediately preceding update if any and being the first results otherwise.

***Response to Arguments***

6. Applicant's arguments filed 6 February 2008 have been fully considered but they are not persuasive. Applicant states that Torkkola and Eriksson are not properly



combined, because Eriksson relates to a procedure which Torkkola does not need and for which therefore no motivation for one of ordinary skill in the art at the time the invention was made to search for. Applicant states that Torkkola is not a true blind source separation process; instead it relies on knowing the modulation scheme, the symbol constellation and the baseband source signals' probability density function. Applicant states that Torkkola has no need for Jacobi is for use with unknown signals. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the blind separation, as taught by Torkkola, to include Jacobi-type orthogonal optimization, as taught by Eriksson, because then the objective function would have been minimized using computationally convenient expressions (Eriksson, p 2210, Section 4). Further, the ability to separate signals with less requirement for information about the signals being separated would have been an advantage. Applicant requests the Examiner to specify clearly the Torkkola equation to which the Examiner envisages applying Eriksson's Jacobi and why. However, the claims do not contain any limitations to specific equations.

Applicant states that Torkkola is totally useless for the application described in Applicant's specification to fetal ECG monitoring because the parameters which are known in Torkkola are not known in fetal ECG monitoring. However, the claims do not contain any limitations directed to fetal ECG monitoring.

Applicant states that on page 2201, section 4.1, line 1 of Eriksson refers to "finding statistically independent components". Applicant states that this is a higher order statistics procedure and is not a second order statistics procedure of updating

orthogonality and producing decorrelation to which claims 2, 13 and 24 relate.

However, the equations used to describe further Jacobi optimization in section 4.2 appear to be second order equations. Applicant states that Eriksson does not mention small updates which appear in claims 2, 13 and 24. However, optimizations meet the claim language for a small updates.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MANUEL L. BARBEE whose telephone number is (571)272-2212. The examiner can normally be reached on Monday-Friday from 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eliseo Ramos-Feliciano can be reached on 571-272-7925. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/Manuel L. Barbee/  
Examiner, Art Unit 2857

mlb  
April 25, 2008